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RESEARCH ARTICLE

Association of Dietary Phosphorus Intake with Serum Phosphate: An Observational Study in Maintenance of Hemodialysis Patients

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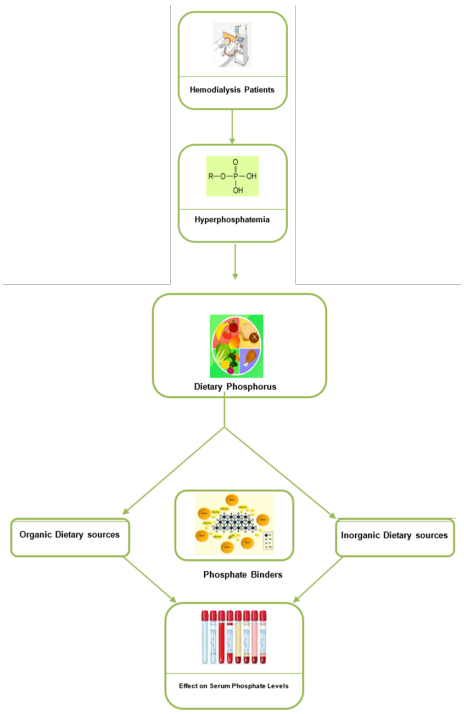
Abstract

Hyperphosphatemia increases mortality in chronic kidney disease (CKD) patients on maintenance hemodialysis (MHD). Hyperphosphatemia in MHD patients is affected by diet and phosphate binders treatment. Thus, we undertook observational research to determine how dietary phosphorus consumption and phosphate binders adherence affect serum phosphate and phosphorus-to-protein ratio (PPR) in MHD. Associations of serum phosphate were examined with identified dietary patterns, organic (plant and animal-based) and inorganic, and whether the patients fully or partially adhered to the phosphate binders. We found a significant difference in phosphate binders on animal and plant sources, high with the animal pattern. However, our study showed no significant correlation in serum phosphate levels. This result could be due to phosphate bioavailability differing by food source and adherence of phosphate binders, which reflect the quantity of phosphate absorbed in the intestines. However, further mechanistic study is warranted.



Keywords: Dietary phosphorus; Maintenance hemodialysis; Serum phosphate; Phosphorustoprotein ratio

1. Introduction

Patients on maintenance dialysis (MHD) have higher rates of death and morbidity when they have hyperphosphatemia [1]. Higher serum phosphate levels have been related to an increased risk of mortality, coronary vascular disease (CVD) and progression to end-stage renal disease (ESRD) in individuals with chronic kidney disease (CKD) [2]. The increased concentration of hyperphosphatemia in MHD individuals is due to inequality between phosphate consumption and removal since dialysis is still the primary method of reducing unwanted phosphate in individuals with impaired renal function [3]. The Kidney Disease: Improving Global Outcomes (KDIGO) worldwide consensus recommendations work group advised in 2009 that serum phosphate values in people with CKD stage 3-5 be kept within the standard laboratory range [4]. Daily phosphate consumption is a critical element of serum phosphate levels in patients under dialysis, and reducing phosphate ingestion considerably lowers serum phosphate levels [3]. Conversely, decreasing dietary phosphate typically results in a concurrent decrease in protein-rich food consumption, which unwittingly impairs dietary protein sufficiency, raising the risk of protein-energy waste [5]. As a result, limiting dietary phosphate intakes in combination with the administration of phosphate binders is an essential part of hyperphosphatemia treatment [2].

Besides consumption and absorption, variables such as net bone, tissue retention, and volume status may alter 24-hour urine phosphorus excretion in CKD [6]. A recent study discovered considerable variability in 24-hour urine phosphorus in mild CKD patients on strictly restricted food consumption [7]. As a result, phosphorus concentrations in dialysis patients must be managed

using an organized strategy that includes dietary regulation and medicinal therapy as needed. Likewise, phosphorus regulation must be seen in the context of the whole complexity of mineral homeostasis and the assessment to determine processes that influence disease development, including the distinct roles of the kidney, gut, and bone in contributing to serum phosphate levels. The diversity of dietary phosphate bioavailability, by both provenance organic of animal or plant source or inorganic, is becoming better recognized[8]. As a result, bioavailability is lowest for plant-derived phosphate (10-30%), preceded by animal-derived phosphate (40-60%), and most significant (100%) for inorganic phosphates found in food supplements. As a starting step, dietary phosphorus management should include total phosphorus concentration and phosphorus bioavailability in organic vs inorganic sources. Phosphorus may be regulated further with hemodialysis and using medicines such as phosphate binders, active/analogue vitamin D, and calcimimetics[9]. Because routine dialysis and diet alone are insufficient in most patients to bring phosphorus levels to within the normal range, another drug therapy is often required. Phosphate binders are intended to be taken with meals to restrict the quantity of phosphorus accessible for absorption in the gastrointestinal system.

The normal person consumes 1000-1200 mg of phosphorus daily, with the intestines absorbing roughly 800 mg. Around 70% of phosphorus in the human body is intracellular, 29% is in bone, and less than 1% is in the blood. In contrast to the hand, phosphorus is eliminated via the GI tract (150 mg/day) and the kidneys (800 mg/day)[10]. Phosphorus (P) elimination in the urine could represent phosphorus absorption in the intestine, which contains both inorganic and organic phosphorus (from proteins). It is widely recognised that urine urea nitrogen (UUN) concentration indicates the amount of protein ingested and metabolized[11]. A rise in the ratio of P/UUN in the urine should be expected if the consumption of inorganic P exceeds that of organic P. The previous investigation reveals that the quantity of P generated in a 24-hour urine sample does not correspond with the amount consumed daily. However, it was shown that inorganic P consumption corresponds with the ratio of P/UUN in urine, and individuals who consume processed foods had an increase in P/UUN in urine[12]. The ideal daily intake of dietary phosphorus, according to K/DOQI standards, is 10-12 mg/g of protein.

Furthermore, K/DOQI standards indicate a diet's phosphorus intake of 12-16 mg/g protein. According to the instructions, patients should consume foods high in protein but low in phosphorus. Similarly, the phosphorus-to-protein ratio helps determine dietary phosphorus in diets with adequate protein but low phosphorus[13]. Furthermore, the dietary phosphorus-to-protein ratio may indicate the risk profile of hemodialysis patients. As a result, this ratio is beneficial in the treatment of dialysis in patients with renal disorders[14]. Phosphorus management is challenging, but it is crucial for CKD patients' overall health and well-being, and understanding how and why phosphorus should be managed is vital for all health practitioners. According to the most recent KDIGO recommendations, one out of every three patients does not have phosphorus levels below 5.5 mg/dL, and two out of every three do not have levels within the normal phosphorus range[4]. This shows that the phosphorus treatment method in hemodialysis patients should be revisited. In the integrated method to manage phosphorus in CKD, diet, dialysis, and medications are used together. Consequently, using Phosphate binders combined with Dialysis and proper phosphorus protein ratio could be effective under the right conditions. As a result, this study aimed to look into the relationship between dietary patterns (from organic and inorganic sources) and serum phosphate levels in MHD patients.

1.1 Objectives

1. The relationship between dietary phosphorus consumption and the phosphorus-to-protein ratio in hemodialysis patients
2. The correlation between dietary phosphorus to protein ratio and serum phosphate levels in dialysis patients.
3. The interaction between Phosphate binders treatment adherence and serum phosphate levels in hemodialysis patients

2. Methods

2.1 Study design

This observational study was performed in a dialysis center. For this study, a total of 50 MHD patients were enlisted, and the total study duration was six months. Inclusion criteria included MHD patients aged $\geq$18 years old and Outpatients undergoing MHD for a minimum of 8 weeks. Exclusion criteria were patients unwilling to participate, patients toward poor adherence to strict diet, poor adherence to hemodialysis treatment, unfit for assessment due to physical or mental disability, or with terminal illness such as HIV/AIDS or malignancy. Each study subject was reviewed carefully by physicians such as the patient's medical history and treatment procedures, and data indicating kidney function and other relevant data were extracted. For grading the comorbidities, a modified Charlson comorbidity index was used[15,16].

Ethical approval was obtained from the Medical Research and Ethics Committee, Ministry of Health, Malaysia (reference number: NMRR-15-865-25260). All eligible patients gave written informed consent and all research procedures were conducted in accordance with relevant guidelines and regulations.

2.2 Data collection

The data on MHD, as well as important socio-demographic data and the patient's past medical history, were gathered from the medical records. At regular intervals, self-reported compliance data on the use of phosphate binders were gathered and analysed. The biochemical test results were obtained from the patient's laboratory test reports within two weeks of dietary data collection. The tests to assess serum phosphates, total serum proteins were conducted monthly in certified labs using approved techniques. Data about the patient's body weight were obtained from medical records.

Dietitians conducted a nutritional evaluation in accordance with the authorized guidelines. The trained dietitians did a 24-hour dietary recall of the meals and drinks. Diet consumption was quantified using widely accessible measuring techniques. In addition, patients were asked about their dietary-related social behaviors. Plant, animal, and processed foods were among the food products classified. Vegetables and lentils are examples of plant-based protein diets. Nuts, legumes, and chickpeas Egg, fish, chicken, lamb, dairy products, and beef are examples of animal protein diets. The USDA database was used to determine the dietary protein and phosphate composition of food. As mentioned in a previous work, we also analyzed dietary phosphate consumption from both organic and inorganic phosphates in this investigation [17].

2.3 Statistical analyses

The mean, standard deviation, were calculated for continuous variables, whilst categorical variables were expressed as frequency (percentages). To examine the association between two categorical variables regression analysis was used. SPSS version 25 was used for all of the analyses (IBM, Chicago, IL, USA). For all parameters studied, the statistical significance was determined using a p-value of less than 0.05.

3. Results

This study aims to find the association of dietary phosphorus intake with serum phosphate levels in the maintenance of hemodialysis patients**.** The data was collected from CKD patients on Haemodialysis, and this study had a sample size of 50 patients. The collected data were entered into excel and analyzed using SPSS version 22.0. Descriptive statistics and frequency tables were computed for demographical and study variables. The association between the variables was discovered using regression analysis.

Table 1 represents the frequency table for the patients' demographic variables and medical conditions. The majority of 70.0% of the patients were Male, and 30.0% were Female. While considering the BMI of the patients, 52.0% of the patients were under Normal weight, 20.0% of the patients were Underweight, 18.0% of the patients were under Overweight, and only 5% of the patients came under Obesity. And all the patients belonged to India, and their financial level was moderate. And for Comorbidities, 20.0% of the patients are with hypertension and 16.0% of the patients with Diabetes mellitus.

Table 1. Frequency table for demographic and study variables

Variables	Category	N (%)
Gender	Female	15 (30.0)
	Male	35 (70.0)
BMI	Underweight	10 (20.0)
	Normal Weight	26 (52.0)
	Overweight	9(18.0)
	Obesity	5 (10.0)
Ethnicity	Indian	50 (100.0)
Income group	Middle Income	50 (100.0)
Comorbidities	Diabetes (DM)	8 (16.0)
	Hypertension (HTN)	10(20.0)
Phosphate binder prescription (Sevelamer Carbonate)	Full adherence to Phosphate binders	27 (54.0)
	Partial adherence to Phosphate binders	10 (20.0)
Dialysis Visit per month	3 days/ week	34 (68.0)
	2 days/ week	16 (32.0)

If the serum phosphate level was (>5.51mg/dL) then the patients were instructed to start their drug dose with one tablet per meal, so totally it was prescribed to 74.0% of the patients; among them, only 54.0% of the patients were full adherence to Phosphate binders, and 20.0% of the patients were partial adherence to Phosphate binders. Only 68% of patients were fully compliant with dialysis visits of three days a week, while 32% attended hemodialysis two days a week.

Table 2. Descriptive statistics for demographic variables

Variables	Mean	SD	Maximum	Minimum
Age (in years)	50.08	15.11	88.00	23.00
Height (in Cm)	163.82	14.75	256.00	148.00
Weight (in Kg)	61.28	13.29	89.00	38.00
BMI (Kg/m^2)	22.60	4.52	33.00	13.00
Dry weight (in Kg)	59.74	13.11	88.00	36.00

Table 2 represents the mean and Standard deviation for the demographic variables. The mean age of the patients

included in the study was 50.08 ±15.11; the mean and Standard deviation of height and weight of the patients were 163.82 ±14.75 and 61.28 ±13.29, respectively. The mean and Standard deviation value for BMI was 22.60 ±4.52, so the patients' average BMI was under the Normal weight, and 59.74 ± 13.11 was the mean and Standard deviation for the dry weight of the patients.

Table 3 represents the distribution of the mean value of the dietary Phosphorus intake such as Organic animal phosphorus, Organic plant phosphorus, Inorganic Phosphorus, Total Phosphorus intake, and Phosphorus to protein ratio (mg/grams) for the month from October to March.

The highest mean dietary intake for Organic animal phosphorus was in December (391.82 ± 83.14), Organic Plant phosphorus was high in December (253.46 ± 73.03), and Inorganic phosphorus intake increased in November (79.08 ± 19.28). The Phosphorus to protein ratio was high in March (20.75 ± 4.09).

Table 4 represents the impact of Phosphorus to protein ratio on Serum phosphate levels and 24 hours of urine phosphate using multiple linear regressions. The table also contains the mean, minimum and maximum values for serum phosphate levels and 24 hrs.—urine phosphate for every month. While considering the effects of the Phosphorus protein ratio on serum phosphate level for Hemodialysis patients, the p-value is less than 0.05 for November(β= 2.513, t= 3.573, p=0.001<0.05), it shows a positive significant impact of Phosphorus protein ratio on Serum phosphate level. Hence, it was concluded that there is a positive significant impact of the Phosphorus protein ratio on Serum phosphate level. Then the impact of the Phosphorus to protein ratio on 24 hours of urine phosphate for Hemodialysis patients, the p-value is greater than 0.05 every month. Hence, it was concluded that there is no significant difference in the Phosphorus to protein ratio on 24 hours of urine phosphate.

Table 5 represents the mean, minimum and maximum value for Serum Phosphate level and 24 hours of urine phosphate based on monthly phosphate binder therapy adherence.

Table 6 llustrates the impact of phosphate binder therapy adherence on serum phosphate levels and 24 hours of urine phosphate. Since the p-value is greater than 0.05 for the Serum Phosphate level every month, it was concluded that there is no significant difference between Phosphate binder therapy adherences on serum phosphate level. At the same time, regarding Phosphate binder therapy adherence on 24 hours of urine phosphate, the p-value is greater than 0.05 every month. Hence, it was concluded that there is no significant difference between Phosphate binder therapies on 24 hours of urine phosphate.

Since there was minimal difference between the full adherence and partial adherence of Phosphate binders, it doesn't show any impact on serum phosphate level and 24 hours of urine phosphate.

4. Discussion

In this study, there was no significant association between dietary phosphate and phosphate binders of completely adhered and non-adherent on serum phosphate levels. There are many possible explanations for this null outcome. To begin with, since phosphate bioavailability varies by food source, total dietary phosphate ingestion does not precisely represent the amount of phosphate assimilated in the intestines[18]. Second, utilizing diet, phosphate binders, and nutrient composition databases, patients' dietary phosphate intakes were determined. Finally, some studies have shown differences in the phosphate amount derived from diet recalls utilizing food composition databases employing direct laboratory analyses on duplicate portions of meal samples[19]. Contrasting to reduced projections based on food content database consultation, the extensive use of phosphate binders in food manufacturing raises the burden of dietary phosphate consumption[19]. Furthermore, we discovered that serum phosphate levels were negatively associated with parameters such as dialysis effectiveness and compliance to Phosphate binders prescription. This shows that treating hyperphosphatemia in MHD patients entails more than just limiting dietary phosphate intake. In reality, Lynch et al.[13] have shown that recommended dietary phosphate restrictions do not correlate with higher survival. As a result, government and private hospitals may have access to more personnel and treatment options in order to achieve the required serum phosphate level.

Because phosphorus consumption may limit the amount of phosphorus accessible for assimilation in the gut, dietary knowledge and control are critical in the treatment of hyperphosphatemia in patients undergoing continuous dialysis. However, phosphorus-rich foods are abundant in the typical diet (e.g., meats and fish, nuts, whole grains, legumes, and cheese) and include a variety of vital nutrients. As a result, limiting phosphorus-rich meals may be challenging for CKD patients, and malnutrition is a major worry in this already nutritionally challenged patient group. Furthermore, healthy diets might be more inconvenient and costlier than cheap fast food that is rich in added phosphorus. The phosphorus load of what we consume is affected by a number of variables, including the food source (animal vs. plant-derived), the inclusion of phosphate additions, and the technique of food preparation St-Jules et al.[20], all of which may affect phosphorus bioavailability. We discovered a significant variation in phosphorus sources (Table-3). This is exacerbated further by various hidden phosphorus sources in meals and drugs[21].

The recommended daily limit of phosphorus for individuals in the United States is 900 mg/day. The phosphorus level of a regular diet is typically related to the quantity of protein, and the three primary sources of phosphorus are pro-

Table 3. Periodic Dietary Phosphorus intake and Phosphorus to protein ratio (PPR) among Hemodialysis patients

Variables	October	November	December	January	February	March
	Mean ± S.D					
Organic Animal phosphorus	347.12 ± 91.12	355.44 ± 100.90	391.82 ± 83.14	377.54 ± 89.12	292.06 ± 78.08	348.22 ± 79.76
Organic Plant phosphorus	190.12 ± 75.51	236.30 ± 71.81	253.46 ± 73.03	208.38 ± 78.11	181.48 ± 52.65	236.74 ± 72.70
Inorganic Phosphorus	79.7 ± 29.12	79.08 ± 19.28	73.78 ± 12.79	71.41 ± 13.70	60.86 ± 11.63	71.02 ± 15.03
Phosphorous to protein ratio (mg/grams)	14.67 ± 3.50	13.01 ± 3.00	15.62 ± 2.45	14.64 ± 2.31	14.15 ± 3.20	20.75 ± 4.09

Table 4. Impact of Phosphorus protein ratio on Serum phosphate level and 24 hours urine phosphate for Hemodialysis patients. In the tableDependent Variable: Phosphorus to protein ratio (mg/grams) was considered significant when **p<0.01

Category	Variables	Mean	Minimum	Maximum	B	Std. Error	R- square	t	Sig.
October	(Constant)				19.58	3.377	0.056	5.799	0.000
	Serum phosphate level	5.82	3.80	10.30	-0.172	0.447		-0.386	0.702
	24 hrs. urine phosphate	3.84	2.50	5.10	-1.019	0.658		-1.548	0.128
November	(Constant)				3.668	3.56	0.222	1.03	0.308
	Serum phosphate level	5.69	4.30	7.50	2.153	0.603		3.573	**0.001****
	24 hrs. urine phosphate	3.80	2.50	5.10	-0.765	0.497		-1.541	0.130
December	(Constant)				21.847	4.065	0.048	5.375	0.000
	Serum phosphate level	5.41	4.30	8.20	-0.728	0.568		-1.281	0.207
	24 hrs. urine phosphate	3.65	2.70	5.00	-0.628	0.663		-0.946	0.349
January	(Constant)				16.454	3.709	0.017	4.436	0.000
	Serum phosphate level	5.20	3.80	8.00	0.067	0.557		0.121	0.904
	24 hrs. urine phosphate	3.63	2.60	5.00	-0.597	0.667		-0.895	0.375
February	(Constant)				13.07	4.278	0.083	3.055	0.004
	Serum phosphate level	5.16	3.60	7.50	1.056	0.675		1.565	0.124
	24 hrs. urine phosphate	3.59	2.40	4.90	-1.217	0.804		-1.514	0.137
March	(Constant)				16.631	5.84	0.011	2.848	0.007
	Serum phosphate level	5.08	3.90	7.10	0.478	1		0.479	0.635
	24 hrs. urine phosphate	3.54	2.00	4.70	0.477	0.96		0.497	0.621

teins, dairy products, and cereals and grains. Cereal grains (120-360 mg/100 g), cheese (220-700 mg/100 g), egg yolk (586 mg/100 g), legumes (300-590 mg/100 g), and fish and meat (170-290 mg/100 g) have the largest quantities of naturally occurring phosphorus. Phosphorus levels in processed meals are greater than in fresh foods Watanabe et al.[22], making it difficult to acquire an accurate assessment of dietary phosphorus consumption. Furthermore, food labels include minimal information on phosphorus levels[23]. Phosphoric acid, polyphosphates, and pyrophosphates are frequent food additives or preservatives in processed meats (e.g., chicken nuggets, hotdogs), cheese spreads, sauces and dressings, bread items, soft drinks, and red wine; such additions may boost phosphorus consumption by up to 1 g/day[24]. When compared to fresh meals, proteins with phosphorus-containing additions give around double the phosphorus per gramme of protein. Because of variability in phosphorus bioavailability, or the proportion of phosphorus digested and taken up systemically by the body, the crude amount of phosphorus in foods does not reflect true phosphorus exposure. Phospho-

Table 5. Mean value and Maximum, and minimum value for Serum phosphate level and 24 hours urine phosphate

Month	Phosphate binders therapy adherence	Variables	Minimum	Maximum	Mean
October	Full adherence	Serum phosphate level	4.8	8.5	6.19
	Partial adherence		4.7	10.3	6.26
	Full adherence	24 hrs. urine phosphate	2.7	5.1	4.13
	Partial adherence		2.8	4.6	3.63
November	Full adherence	Serum phosphate level	5.1	7.5	5.87
	Partial adherence		4.8	7.3	5.84
	Full adherence	24 hrs. urine phosphate	2.6	5.1	4.09
	Partial adherence		2.8	4.9	3.69
December	Full adherence	Serum phosphate level	4.3	6.3	5.43
	Partial adherence		4.8	8.2	5.54
	Full adherence	24 hrs. urine phosphate	2.8	5	3.84
	Partial adherence		3.2	4.1	3.61
January	Full adherence	Serum phosphate level	4.3	6.3	5.24
	Partial adherence		3.8	8	5.21
	Full adherence	24 hrs. urine phosphate	2.8	5	3.82
	Partial adherence		3.1	4	3.54
February	Full adherence	Serum phosphate level	4.2	6	5.17
	Partial adherence		3.6	7.5	5.25
	Full adherence	24 hrs. urine phosphate	2.4	4.9	3.81
	Partial adherence		3	4.1	3.51
March	Full adherence	Serum phosphate level	4	7.1	5.17
	Partial adherence		3.9	6.5	4.99
	Full adherence	24 hrs. urine phosphate	2	4.7	3.76
	Partial adherence		3	4.1	3.5

rus bioavailability is dependent on the food source and generally increases from plant to animal to inorganic sources[25]. Despite the high phosphorus content in plant-derived meals, mammals lack the enzyme phytase, which is needed to break down this form of phosphorus, resulting in poor GI absorption and bioavailability[26]. Phosphorus in meat, on the other hand, is readily digested and absorbed, and up to 100% may be absorbed from diets containing additions. Because phosphorus absorption is linear across a wide range, the quantity and bioavailability of phosphorus consumed is critical. However, there is a scarcity of evidence-based data on real phosphorus absorption, which may be difficult to assess in human feeding trials and can be influenced by the presence of other minerals in the gut, such as vitamin D. As a result of the complexities of oral consumption, estimating real phosphorus ingestion in relation to absorption is difficult. It is estimated that 30% of dialysis patients use at least one phosphorus-containing medicine, and the median phosphorus load from prescribed drugs may exceed 100 mg/day. Given that more than 25% of patients with severe CKD are prescribed, this phosphorus source is therapeutically relevant. Approximately 90% of phosphorus-containing pharmaceuticals are cardiovascular and central nervous system treatments. Patients should be urged to eat meals with low inorganic phosphate content, low phosphorus-to-protein ratios, and enough protein content. In maintenance dialysis patients, caution should be used to prevent concurrent decreases in dietary protein, since a low-protein diet may result in protein energy wasting, and uremic malnutrition, all of which are linked with increased mortality. Dialysis patients who consume more protein, on the other hand, have greater serum albumin, more body mass, and a better chance of survival. However, with a rec-

Table 6. Impact of Phosphorus binder therapy adherence on Serum phosphate level and 24 hours urine phosphate for Hemodialysis patients. Dependent Variable: Phosphate binder prescription (Sevelamer Carbonate)

Category	Variables	B	Std. Error	R- square	t	p-value
October	(Constant)	3.090	1.304	0.098	2.370	.024
	Serum phosphate level	.001	.150		.005	.996
	24 hrs. urine phosphate	-.389	.203		-1.911	.064
November	(Constant)	3.085	1.823	0.060	1.693	.100
	Serum phosphate level	-.062	.270		-.228	.821
	24 hrs. urine phosphate	-.297	.202		-1.468	.151
December	(Constant)	2.665	1.909	0.045	1.396	.172
	Serum phosphate level	.047	.233		.203	.840
	24 hrs. urine phosphate	-.366	.311		-1.177	.247
January	(Constant)	3.638	1.664	0.072	2.186	.036
	Serum phosphate level	-.039	.219		-.178	.860
	24 hrs. urine phosphate	-.505	.312		-1.618	.115
February	(Constant)	2.773	1.474	0.067	1.881	.069
	Serum phosphate level	.074	.207		.358	.723
	24 hrs. urine phosphate	-.434	.282		-1.540	.133
March	(Constant)	3.518	1.493	0.056	2.357	.024
	Serum phosphate level	-.151	.226		-.669	.508
	24 hrs. urine phosphate	-.327	.266		-1.230	.227

ommended daily protein consumption of 1-1.2 g/kg/day for dialysis patients, it is exceedingly difficult to maintain phosphorus levels below 900 mg/day; assuming a phosphorus-to-protein ratio of 14, the phosphorus intake with meals for an 80 kg patient is around 1,340 mg/day. Furthermore, since foods with phosphate additions have a phosphorus concentration that is almost 70% higher than those without additives Benini et al.[27], strict management of dietary phosphorus intake is an important but difficult part of delivering treatment to CKD patients undergoing dialysis. Limiting phosphorus consumption by eating meats and poultry without breading, marinades, or sauces, and seafood is a good source of low-fat protein with less phosphorus than red meat. Other methods for increasing protein while limiting phosphorus consumption include using dairy replacements and egg white in cooking and baking, since the yolk carries the bulk of the phosphorus in eggs. Patient awareness and adaptability are ongoing discussions. As a result, assessing the habitual food pattern may give useful insights for the nutritional therapy of hyperphosphatemia in MHD patients. Future research on the efficacy of dietary pattern management on hyperphosphatemia in MHD patients is needed.

5. Conclusion

The dietary pattern of HD patients reveals that 68% take dairy products daily, whereas 48% of patients ingest eggs daily. Under the weekly, once group, chicken (66.7%) was eaten in larger numbers, followed by fish (20%) and beef (8%). On the other hand, lentils were virtually eaten regularly by 96% of the patients. Importantly, 48% of patients ate processed foods daily. Our findings reveal no significant relationships between the mean (>=5.5mg/dl) serum phosphate level and phosphorus protein ratio consumption levels (p=0.591). 2/week and 3/week MHD adherence MHD have similar serum phosphate levels (p=0.674). 2/week and 3/week HD adherence did not differ in phosphorus protein ratio intake (p=0.802). Overall, the findings reveal a lack of relationship between the dietary phosphorus consumption with serum phosphate and phosphorus to protein ratio levels in MHD patients. These findings must be confirmed by larger studies. Future research might also concentrate on adequate measurement of patient total daily intake and its influence on serum phosphate levels.

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